On a Rational Criterion for Assigning Batch Number to Processed Products of Shrimps

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[Investgations were conducted to find the variability of processed shrimps with respect to two quality characteristics, namely, the numbers of deteriorated and discoloured pieces. Samples were collected for three days from two arbitrarily selected processing factories from Cochin at the pre-freezing stages. Results show that both the quality characteristics vary significantly between different size-grades, but while the variation in the number of deteriorated pieces between days is not significant, the variation in the number of discoloured pieces between days is significant.]

Introduction

The export of processed shrimps to the United States has gained considerable importance recently and attempts are being made to increase the volume of export of this product. For this purpose, it is essential to ensure that the quality of the exported products conform consistently to certain standards. The Indian Standards Institution have prescribed the necessary physical and bacteriological standards for frozen shrimps (IS 2237, 1962). An investigation was carried out to find out a method of quality control at the pre-shipment stage to ensure that the frozen shrimps conformed to these standards.

The discrete nature of shrimp landings by indigenous boats over a wide area and the transport of these to the factories suggest a good deal of day to day variation. Besides it is common knowledge that different sizes of shrimps will be differently affected in the handling process and therefore the quality of the raw shrimps are expected to vary according to size. These two factors were kept in view in planning a design of sampling (described below) for the purpose of this study.

The primary objective of the present study was to examine the amount of variability existing in the material at the final stage of processing and to fix the criterion of giving batch numbers to the finished products in a rational way, so that the products having the same batch number may be considered as homogeneous.

Experimental Procedure

The processed product chosen for this purpose was frozen shrimps (prawn). Two shrimp processing factories at Cochin were selected and in each factory, data were collected for 3 days at an interval of about 3-4 days. On each day, samples of 50 shrimps from each size-grade were collected at the pre-freezing stage at an interval of about 15 minutes. Samples from all the size grades were not available at all sampling points. Only two physical characteristics, viz., the number of deteriorated and the number of discoloured pieces in each sample of 50 were counted. The data were collected by a single trained field operator so that personal bias, if any, would be more or less uniform.

Results and Discussion

The Table I presents the mean values of the two characteristics studied for different size-grades for each day of observation for each of the factories from where data were collected.

TABLE I. — Mean Number of Deteriorated and Discoloured Pieces in samples of 50 Pieces

(a) First Factory

Size-grade	No. of deteriorated pieces on			No. of discoloured pieces on		
	1st day	2nd day	3rd day	1st day	2nd day	3rd day
41 - 60	1.38	1.06	1.57	12.85	12.59	12.26
61 - 100	1.78	2.00	2.13	16.56	15.45	15.13
101 and above	3.79	2.60	2.44	18.84	17.40	16.89

(b) Second Factory

Size-grade	No. of deteriorated pieces on			No. of discoloured pieces on		
	1st day	2nd day	3rd day	1st day	2nd day	3rd day
61 - 70	1.20	0.93	1.60	13.40	11.80	11.33
71 - 90	1.33	1.47	1.47	14.25	12.80	12.27
91 - 100	2.88	1.87	2.00	16.88	17.87	16.27
101 - 130	2.50	2.80	1.73	17.80	17.87	17.33
130 and above	4.57	3.73	2.67	22.14	20.13	19.33

A look at the mean values of the two characteristics studied shows that as the size-grade becomes smaller the number of both deteriorated and discoloured pieces increases. This was expected on *a priori* considerations. The tables also show that for the same size-grade, the numbers of deteriorated and discoloured pieces vary considerably. If the

number of samples for each size-grade were the same on all days, ordinary analysis of variance would have shown whether the observed differences in the mean values are really significant or not. It has however been pointed out that the same number of samples could not be collected for each size-grade on all the days. The number of samples for each size-grade varied within the day and also between days. This introduces non-orthogonality in the data.

Taking the mean values of Table I, a preliminary analysis of variance was made. The results are presented in Table II.

TABLE II.–Preliminary Analysis of Variance to Test Homogeneity of Sub-Class Means

(a) First Factory

Source of variation	d. f.	Deteriorated pieces S. S.	M. Sq.	F.	Discoloured pieces S S.	M. Sq.	F.
Sub-classes	8	97.84	12.23	3.56**	786.53	98.32	28.88**
Error	155	533.28	3.44		527.71	3.40	
Total	163	631.12			1314.24		

(b) Second Factory

Source of variation	d. f.	Deteriorated pieces S. S.	M. Sq.	F.	Discoloured pieces S. S.	M. Sq.	F.
Sub-classes	14	286.84	20.49	6.40**	2735.95	195.42	83.16**
Error	233	745.87	3.20		548.14	2.36	
Total	247	1032.71			3284.09		

For both the characteristics studied, the sub-class means were found to be significantly different.

Detailed analyses of variance appropriate to non-orthogonal data for testing differences in qualities among sizes and also among days are presented in Table III for both the characteristics.

TABLE III. — Completed Analysis of Variance

(a) First Factory

Source of variation	d. f.	Deteriorated pieces S. S.	M. Sq.	F.	Discoloured pieces S. S.	M. Sq.	F.
Size-grades (adjusted)	2	80.00	40.00	11.63**	744.12	372.06	109.28**
Days (adjusted)	2	6.10	3.05	<1	45.02	22.51	6.61**
Interaction	4	15.20	3.80	1.10 (N.S.)	11.58	2.89	<1
Error	155	533.28	3.44		527.71	3.40	

(b) Second Factory

Source of variation	d. f.	Deteriorated pieces S. S.	M. Sq.	F.	Discoloured pieces S. S.	M. Sq.	F.
Size-grades (adjusted)	4	180.02	45.00	14.06**	2249.32	562.33	238.73**
Days (adjusted)	2	14.73	7.36	2.30 (N.S.)	101.14	50.57	21.47**
Interaction	8	61.97	7.75	2.42	66.30	8.29	3.52**
Error	233	745.87	3.20		548.14	2.36	

So far as the characteristic deterioration is concerned, the interaction term calculated by the method of fitting constants, was found to be non-significant in the case of the first processing factory, but it was found to be significant at 5% level of probability, though not so at 1% level in the case of the second processing factory. Further, in case of both the factories studied, adjusted mean squares between days were found to be non-significant, while the adjusted mean squares for size-grades were highly significant. Regarding the characteristic discolouration, analyses show that in the case of the first factory, the interaction term was non-significant, but differences between both size-grades and days were found to be significant. For the second factory, the differences among both size-grades and days are highly significant.

The above analyses show that on the basis of the two characteristics 'the number of deteriorated pieces' and 'the number of discoloured pieces' in the sample, there are significant differences among the various size-grades of shrimps and also in the materials from day to day. So, for a successful quality control inspection scheme, it is necessary to give identifying batch number to the finished product of shrimps of a particular size-grade for each day, so that the processed material bearing the same batch number may form a more or less homogeneous lot.

Of the two characteristics chosen to study the variability of the material at the pre-freezing stage, the number of discoloured pieces in a sample of fifty cannot probably be taken as a very reliable indicator for judging the differences in qualities among the different size-grades, as a discoloured piece is not necessarily deteriorated, unless it is at a very advanced stage of discolouration. If the quality is judged on the basis of the number of deteriorated pieces found in the sample of 50 at the pre-freezing stage, it is found that while significant differences exist among various size-grades, day effects were not significant at all. This means that for forming lots to be presented for quality control inspection at the pre-shipment stage, products of same size-grades manufactured on different dates could be combined together. From the view of prevalent commercial practice of processing, this finding is highly important. Larger size shrimps are not processed in large quantities every day. Hence formation of lots of larger shrimps processed on several different dates will be convenient for both the manufacturer and for the inspecting staff.

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The exact physical interpretation of the interaction term is difficult. It is likely that the sorting out of the raw materials into various recognised size-grades is not very rigid and may vary from day to day. This may give rise to the interaction term. There is thus need to keep a close watch to see that proper sorting out into different size-grades is effected on various days according to the prescribed scales.

Summary

Observations were taken on samples of fifty pieces of shrimps of different size-grades for three days from two shrimp processing factories at the pre-freezing stage on two quality characteristics to find the effect of days and size-grades on these factors. Both the quality characteristics are found to be significantly different over different size-grades and only one characteristic over different days in both the factories. The interaction term with respect to both the characteristics was found to be significant in one of the factories. The imperfect way of sorting out the shrimps into different size-grades was ascribed as the probable reason for this.

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Reference :

IS.: 2237 — 'Indian Standard' for Frozen Prawns (Shrimp) (1962).